A SPATIAL NONLINEAR MATHEMATICAL MODEL ON THE IMPACT OF VECTOR CONTROL STRATEGIES AND THE DYNAMICS OF MALARIA TRANSMISSION

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ABSTRACT

Malaria is a life-threaten illness with negative effects on both the social, and economic aspects of human life. Researching into its curtailment or eradication is necessary for elevating human health and social-economic status. In this regard, this study focuses on the spatial nonlinear mathematical model to investigate how vector control strategies are correlated with the dynamics of malaria transmission. The model employs nonlinear partial differential equations (NPDE) to investigate disease transmission. The model system incorporates both human (host) and mosquito (vector) populations. Some applicable epidemiological mathematical analyses were carried out on the model system such as critical points, stability, the basic reproduction number, local asymptotic stability (LAS), global asymptotic stability (GAS), wave speed, and numerical analyses using relevant data were extensively analysed. Using the sharp threshold conditions imposed on the reproduction number, we were able to show that the model exhibited the backward bifurcation phenomenon and the DFE was shown to be globally asymptotic stable (GAS) under certain conditions. It was found that invasive plants have significant effects on malaria transmission. The study suggests that mosquito repellent plants should be planted around the human environment to replace the invasive plants so as to reduce mosquito shelters and feeding opportunities for mosquitoes.

Keywords Spatial model · invasive plants · global stability · traveling wave

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